makes several observations, rather than when several observers each make one observation, of the same structure.

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EFFECT OF THE NEMATODES *HIRSCHMANNIELLA ORYZAE* AND *H. SPINICAUDATA* ON THE N_2 FIXATION IN THE RICE RHIZOSPHERE

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Nitrogen is one of the most important factors affecting rice production. Biological N_2 fixation by heterotrophic organisms in the rhizosphere is thought to contribute to some extent to the nitrogen in the rice plant (Willis & Green, 1948 ; Rinaudo, Balandreau & Dommergues, 1971 ; Yoshida & Ancajas, 1973). A nitrogen balance study done in 1979 at the International Rice Research Institute, Los Baños, Philippines (App, pers. comm.), showed that the nitrogen input in a Maahas clay soil from nitrogen fixation associated with the rice plant, could constitute 18 to 43% of nitrogen in the plant at harvest.

Rice *(Oryza sativa* L.*)* is a preferred host of most nematode species of the genus *Hirschmanniella*. *H. oryzae* occurs most frequently in all countries where rice is grown. *H. spinicaudata* is common in West Africa and has been reported once in Venezuela. In West Africa a geographical gradient is observed in the distribution of both species : *H. spinicaudata* is highly prevalent in humid areas, whereas *H. oryzae* is found mostly in the Sahelian regions (Fortuner & Merny, 1979). Both nematodes depress and delay tillering and flowering of rice, and reduce root and shoot growth and grain yield (Babatola & Bridge, 1979).

This paper presents the results of a preliminary laboratory experiment set up to evaluate the effect of *H. oryzae* and *H. spinicaudata* on N_2 fixation in the rice rhizosphere.

The soil used was a typical sandy soil of Central Senegal (vernacular name : Dior), with C and N contents of 0.3 and 0.027% respectively, pH 7.5, inoculated with a nitrogen fixing strain *Azospirillum* DK 93 previously shown to enhance N_2 (C_2H_2) fixation in the rhizosphere of rice cv. Moroberekan (Rinaudo, Gauthier & Dommergues, 1979). Pregerminated seeds of rice cv. Moroberekan were placed in 14 × 220 mm Pyrex tubes containing 27 g of soil which was afterward waterlogged (one seed per tube). There

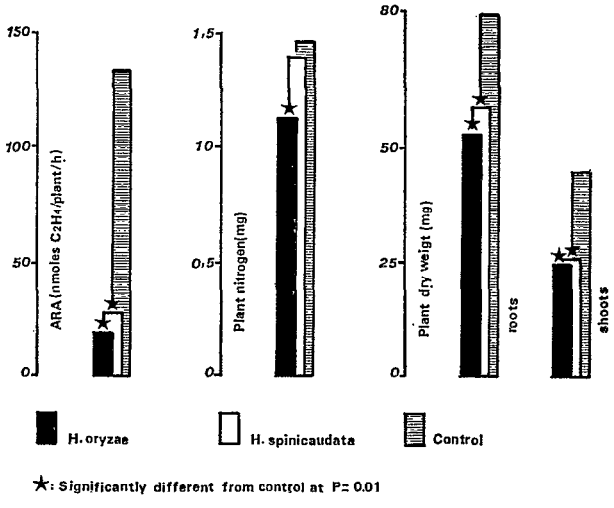

Fig. 1. Effect of infestation of soil with *H. oryzae* and *H. spinicaudata* on rhizospheric acetylene reduction activity (ARA), and plant growth of three-week-old rice seedlings (cv. Moroberekan).

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were three treatments with twelve replications : soil infested with 500 *H. oryzae* or *H. spinicaudata*, and control without nematodes. *H. oryzae* and *H. spinicaudata* were raised on rice cv. Moroberekan in flooded clay pots in the greenhouse. The seedlings were maintained under artificial illumination with a light intensity of 20 000 lux and a 14 h photoperiod. After eighteen days, the nitrogen fixing activity was estimated on six replicates by the acetylene reduction method (Raimbault *et al.*, 1977) and the nitrogen content of the plants determined by the Kjeldahl method on the others.

Both nematodes significantly lowered the rhizospheric acetylene reduction activity (ARA) and the plant dry weight (Fig. 1). Since the rhizospheric ARA of seedlings is known to depend mainly upon root exudation which is linked to plant photosynthesis (Balandreau *et al.*, 1976), the nematodes were assumed to reduce the rate of exudation.

The nitrogen nutrition of the plant seemed to be less affected by the nematodes : its nitrogen content was significantly reduced only by *H. oryzae* (Fig. 1). This result may be explained by the fact that : (i) sufficient nitrogen was available in the seed and in the soil to allow for an adequate nitrogen nutrition of the plant for three weeks, and (ii) the nitrogen originating from N_2 fixation should be mineralized before being absorbed by the plant.

Thus, the nematodes *H. oryzae* and *H. spinicaudata*, appear to be partly responsible for the limitation of non symbiotic N_2 fixation in submerged rice soils.

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MELOIDOGYNE INCOGNITA DEVELOPMENT ON SOYBEAN TREATED WITH SELECTED AMINO ACIDS BY ALTERNATE METHODS

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Preliminary studies on the effect of amino acids against plant parasitic nematodes have indicated some promise for selected amino acids as a component in a pest management program.

Amino acid antimetabolites applied to the soil, have been reported to decrease the numbers of *Paratrichodorus minor (Trichodorus christiei)* and *Meloidogyne incognita acrita* on tomato (Overman & Woltz, 1962). DL-amino acid antimetabolites decreased the population of *Aphelenchoides ritzemabosi* on lucerne, while DL-alanine significantly decreased the number of *Heterodera* without injuring different host plants (Prasad & Webster, 1967). Selected amino acids applied as foliar sprays to tomato plants infected with *M. incognita* were reported to affect the development and reproduction of the nematode (Krishna & Setty, 1974). In subsequent reports (Parvatha Reddy, Govindu & Setty, 1975*a*) certain amino acids were observed toxic to tomatoes as soil drenches, while others reduced galling caused by *M. incognita* without plant injury. Subsequently in axenic cultures (1975*b*) these authors reported that DL-methionine in sterile culture reduced root galling, egg mass production and fecundity of the root-knot nematode, *M. incognita*, and in the process delayed the completion of nematode life cycle by about eight to nine days. The amino acid studies have included four nematodes and three host plants, too few to establish a generality. This

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